ART IV.—*Observations on the Australian Species of Peripatus.*

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[Read July 11, 1889.]

PART I.—HISTORICAL—HABITAT—SPECIFIC CHARACTERS—VARIATION IN EXTERNAL CHARACTERS.

In the January number of the *Victorian Naturalist*, and also in *Nature* for February 14, 1889, I published a short account of the discovery of two specimens of *Peripatus* at Warburton, on the Upper Yarra, which presented external colour markings so well pronounced, and so different from what had usually been described in the only known Australian species, *P. leuckartii*, that I considered the two specimens as probably belonging to a new species. Mr. Sedgwick, in response to my letter, published a note in *Nature* (February 28, 1889), in which he expressed the opinion that the species probably was subject to considerable range of variation in colour. Since the publication of my first account, I have been in correspondence on the subject with Mr. Fletcher, who is well acquainted with the New South Wales specimens of *Peripatus*, and who most kindly sent me a specimen from his collection, and also copies—some in advance of publication—of his own notes on the subject. Mr. Fletcher also tells me, in a letter dated February 22, 1889, that "the New South Wales specimens of *Peripatus* undoubtedly present very considerable variation in colour and markings, and this is true of specimens from the same locality, whereas specimens from different localities can be very fairly matched." This remark is based upon the examination of a specimen sent by Mr. Olliff to Mr. Sedgwick, a specimen in the Australian Museum, and nine specimens in Mr. Fletcher's own collection, which were all that were known at the time he wrote.

A few weeks ago, my friends, Mr. Edward Nye and Mr. D. Avery, of Queen's College, Melbourne University, discovered, after much patient searching, eleven specimens of *Peripatus* at Brown Hill, in the vicinity of Ballarat, which they kindly placed at my disposal in a living and healthy condition. From the examination of these specimens, I have been able to gain a fairly good idea of the extent of variation in colour markings which the species undergoes; and also to make some observations on the internal anatomy. I have come to the conclusion that there is only one Australian species yet known, and the present appears to me to be a good opportunity for bringing together our scattered knowledge concerning it, and recording my own observations. The anatomical part of my paper is not yet ready, although I have already carefully studied the anatomy, by means of dissection and serial sections, but I hope to publish it at a future date, and also to be able to give an account of the development.

HISTORY OF OUR KNOWLEDGE OF PERIPATUS LEUCKARTII.

The species was originally described by Saenger, in 1869. I have not been able to see the original paper, but Sedgwick gives the title as follows:—"Description of a *Peripatus* from Australia," "Transactions of the Russian Assembly of Naturalists," held at Moscow in 1867, Moscow, 1869 (Russian).

This paper was preceded by a preliminary account by the same author, as I learn from the *Archiv für Naturgeschichte* (*Jahrgang* 35, Band 2, p. 277), in which Leuckart, in his "Bericht üb. d. Leist. in d. Naturgeschichte der niederen Thiere während der J. 1868–69," remarks:—"*Onychophori.* Der seit Grube (1853) nicht wieder untersuchte Peripatus wird auf Anregung des Ref. von Saenger zum Gengenstand einer anatomischen Untersuchung gemacht, deren Hauptresultate vorläufig in den Protocollen der Moskauer Naturforscherversammlung mitgetheilt sind." A brief abstract of the paper then follows.

Saenger's complete paper is also noticed in the *Archiv für Naturgeschichte* (Jahrgang 37, Band 2, p. 406.) The notice runs as follows:—"*Onychophori.* Sänger's Untersuchungen über 'Peripatus capensis Gr. und P. Leuckartii,' die wir nach einer vorläufigen Mittheilung schon im letzten Jahresberichte anzogen, sind in den Verhandlungen der Moskauer Naturforscherversammlung, Abth. Zoologie S. 237–262. Tab. XII u. XIII inzwischen ausführlich veröffentlicht. Die neue Art, die aus Neu-Holland stammt, wird folgendermaassen beschrieben: Fünfzehn Paar Fusstummel, von denen das letzte Paar die Geschlechtsöffnung zwischen sich nimmt.

Auf der Unterseite der Füsse drei Erhebungen, von denen die eine lang und bogenförmig ist, während die zwei andern kurz und gerade sind. Länge 21 Mm., grösste Breite 3·05 Mm."

In 1887, Mr. Henry Tryon published an interesting paper "On *Peripatus* and its Occurrence in Australia," in the "Proceedings of the Royal Society of Queensland" (Vol. IV., p. 78). In this paper he announces the re-discovery of *Peripatus* in Australia, and gives a brief account of its structure, habits, and distribution, and to this paper I would especially call the attention of Australian naturalists. In 1886, Mr. Tryon found two specimens of *Peripatus* in a collection of invertebrata from the Cardwell district, sent to the Queensland Museum. These specimens were unfortunately lost in Sydney. A single specimen of *Peripatus* was next found by Mr. Tryon under dead wood in a gully in Victoria Park, Brisbane; and later on several specimens were obtained under stones within a short distance of the General Hospital. The author points out the great resemblance between the Australian and New Zealand species. He likewise observed the important fact that "the external jaw claw is simple, with a slight elevation at the base of the claw proper"; but he did not recognise this character as a distinction between the Australian and New Zealand species, as was subsequently done by Sedgwick.

Concerning the colouration of the body, Mr. Tryon says the species "exhibits the same variation in colouring which occurs in the different species of the genus. . . . The Australian species is very dark blue, almost black, with a few rust-like specs here and there, and lighter coloured beneath; or dark fuscous, with a still darker line along the back."

In the *Annals and Magazine of Natural History* for September of the same year (1887), Professor F. Jeffrey Bell published a very brief note (p. 252) on the "Habitat of *Peripatus Leuckarti*," in which he says:—"Dr. E. P. Ramsay, F.R.S.E., has lately been so kind as to send me two specimens of *Peripatus Leuckarti*, Sänger. Professor Leuckart's only information with regard to the place of origin of his specimen was 'Neu Holland.' It may therefore be of interest to state that Mr. Ramsay's examples were taken in the Queensland Scrubs, near Wide Bay."

The next discovery of *Peripatus leuckartii* took place in Victoria, and is recorded by Mr. Fletcher in the "Proceedings of the Linnean Society of New South Wales" (Vol. II., Part I., 1887). Mr. Fletcher observes:—"The specimen which I exhibit this evening was given to me a fortnight ago by my friend Mr. R. T. Baker, of Newington College, who had obtained it a few days previously either in or under a rotten log at Warragul, Gippsland, Victoria. It has fifteen pairs of claw-bearing appendages, and has nearly the same dimensions as are given in the abstract referred to. It is, therefore, in all probability an example of *P. Leuckartii*, Sänger." The specimen was received by Mr. Fletcher in a dried-up condition, so that he was not able to make any further observations upon it.

At a meeting of the Linnean Society of New South Wales, on November 27, 1887, Mr. A. Sidney Olliff exhibited and read a note upon a specimen of *Peripatus leuckartii* which had been obtained by himself and Mr. H. Merewether at the foot of a grey gum tree at Cassilis, on the banks of the Mounmoura Creek, a tributary of the Goulburn River. This is the first recorded discovery of *Peripatus* in New South Wales. Mr. Olliff says in his note:—"During life my specimen was coloured as follows:—Shining slaty-brown above, dusted with brick-red, with a dusky-red patch on the head, and a moderately distinct dusky-red lateral line on each side extending throughout its entire length; below, pinkish grey; the antennæ dark brown. It measured 21 mm. when fully extended."

In April 1888, Mr. Sedgwick's beautiful "Monograph on the Species and Distribution of the Genus *Peripatus* (Guilding)" was published in the *Quarterly Journal of Microscopical Science.* The author's observations on *P. leuckartii* were confined to the two specimens sent by Mr. Ramsay to Professor Bell, and the only locality which he gives for the species is "near Wide Bay, Queensland." The species is diagnosed as follows:—"Australasian Peripatus, with fifteen pairs of legs, an accessory tooth on the outer blade of the jaw, and a white papilla on the ventral side of the last leg of the male." Professor Bell's two specimens are described, and a few anatomical details are given. The species is not figured.

At the meeting of the Linnean Society of New South Wales of June 27th, 1888, Mr. Fletcher exhibited and described seven more specimens of *Peripatus*, obtained on a country road near Wollongong, New South Wales. Three of the specimens he preserved alive, and he gives a detailed account of the size and colouration of these.

On October 31, 1888, the same author exhibited some young specimens, the progeny of one of the three exhibited at the last meeting. The size and colouration of these young specimens (four in number) is briefly noted.

On November 28, 1888, again, Mr. Fletcher exhibited at the same Society's meeting two living specimens of *Peripatus leuckartii* from Burrawang, County of Camden, and their general colouration is briefly noted.

Peripatus leuckartii was next met with again by myself in Victoria; from which colony, it will be remembered, it was hitherto represented only by a single dried-up specimen from Gippsland. In December last, I found two specimens in a fern-tree gully at Warburton, on the Upper Yarra; and I recorded the discovery, with a brief account of the specimens, in the *Victorian Naturalist* and *Nature* (*locc. citt.*). Owing to the very distinct and definite markings on both of my specimens, I thought that they would probably prove to belong to a species distinct from *P. leuckartii*. Subsequent research, however, has shown that this is not the case.

Finally, the latest literature on the subject is a short letter in *Nature*, by Mr. A. Sedgwick, F.R.S., in reply to my own, in which he says:—"The Victorian and New South Wales localities are recorded in a postscript appended to my monograph of the genus as reprinted from vol. iv. of the "Studies from the Morphological Laboratory of the University of Cambridge." . . . . The New South Wales species is, I think, identical with that found in Queensland, and I should be inclined to doubt the distinctness of the Victorian species recorded by Mr. Dendy in *Nature* (p. 366), and previously by Mr. Fletcher. Mr. Dendy appears to lay some stress on the differences of colour as between his specimen and the specimens of *P. leuckarti* hitherto described, but it must be remembered that in some species of Peripatus—*e.g. capensis* and *novæ-zealandiæ*—the range of individual colour-variation is very considerable." Mr. Sedgwick concludes—"Its development cannot fail to be of the greatest interest, and it is sincerely to be hoped that the Australian zoologists will lose no time in working it out."

In the present paper, as already mentioned, I have to record the discovery of eleven more specimens of *Peripatus* in Victoria, obtained by Messrs. Nye and Avery (of Queen's College), at Brown Hill, near Ballarat. The examination of these specimens leaves no doubt as to the correctness of

Mr. Sedgwick's views as to the specific identity of all the Australian specimens.

HABITAT OF PERIPATUS LEUCKARTII.

The animal is generally found beneath either stones or logs—either in open places, or in sheltered ones, such as gullies. They appear to be more frequently met with under stones than in any other situation. The first Victorian specimen was found either in or under a rotten log at Warragul, and the two which I found were both under logs, in a fern-tree gully at Warburton. The animals obtained by Messrs. Nye and Avery were, however, nearly all found under stones, and those gentlemen have kindly furnished me with the following note concerning the habitat of their specimens:—

"Whilst out on an expedition at Brown Hill in the vicinity of Ballarat, in turning over some large silurian stones, we found a *Peripatus* beneath one sunk an inch or so into the earth. On subsequent expeditions, we found ten more—nine of them beneath silurian stones—some under large, and some under small stones, some being sunk in moss and grass, and some lying in bare spots almost devoid of vegetation. The greater part of the range where the *Peripati* were found is bare, and covered with silurian sandstone; further on, it becomes covered with scrubby gum trees, about six to ten feet high, and over-grown with mosses and lichens. Here we found only two.

All these *Peripati* were found beneath silurian, and though quartz and granite were plentiful, in no case did we find any beneath them. Sometimes the *Peripati* were beneath the stones, sometimes clinging to them, and again, in the rubbish around them.

"In one case only did we find two beneath the same stone, and they were small ones. The blue and bluish-brown ones were found in a spot covered with more vegetation and bracken.

"We searched the foot of this range for about a mile and a half here, and then proceeded a couple of miles further along to a part better timbered. Here we found two—one beneath a decaying log, and the other beneath a silurian stone in an open spot. There were few fallen logs, so we had little chance to look for *Peripati* beneath them.

"The range is about three miles N.E. of Ballarat, and runs about east and west, so that the *Peripati* were found at the foot of the south side. A small creek runs along the foot of the range."

SPECIFIC CHARACTERS OF PERIPATUS LEUCKARTII.

I have already quoted Sedgwick's definition of the species —" Australasian Peripatus, with fifteen pairs of legs, an accessory tooth on the outer blade of the jaw, and a white papilla on the ventral side of the last leg of the male." This author states that, after careful search, he has only been able to find three minute points of real difference between the Australian species *(P. leuckartii)* and the New Zealand species (*P. novæ-zealandiæ.*) These are :—

" (1) The outer blades of the jaws have an accessory tooth at the base of the main tooth, as in the Cape species.

" (2) The male has a rounded white papilla on the ventral face of the fifteenth leg, on each side of the genital opening. It is in the same position with regard to the leg as the corresponding structure in the Cape males.

" (3) The pigment on the ventral surface is much less conspicuous in this than in the New Zealand species, so that the mottled appearance presented by the ventral surface of the latter species is not found in these specimens. The pigment on the ventral surface of these specimens is much more marked in the lower parts of the papillæ than elsewhere. In the skin between the papillæ and at the apices of the papillæ the pigment is so faint as to be hardly discernible. The result is that to the naked eye the ventral surface appears quite pale with coloured papillæ projecting from it. The predominant pigment of the ventral surface is the blue, but orange is present. The hind end of the ventral surface in the region of the last three legs is darker than elsewhere, in consequence of the great number of the pigmented papillæ.

" In addition to the above characters, it may be mentioned that the genital papilla of the female is remarkably prominent, and bears at its free end a longitudinally disposed slit. In the male the genital papilla is fairly prominent, but its aperture is wider and more rounded, resembling the same structure in both sexes of the New Zealand species."

The presence of an accessory tooth on the outer blade of the jaw, and of a white papilla on the ventral surface of the fifteenth leg of the male ;* and the prominence of the genital papilla in the female, are all characters of the Victorian specimens examined by me.

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* I have only seen one small male specimen ; which I judge to be a male from the presence of the white papillæ, as mentioned, and the less prominent genital papilla (*vide* description of specimen *i*).

The third diagnostic character given by Sedgwick, however—namely, that concerning the colouration of the ventral surface, and the absence of a mottled appearance therefrom—no longer holds good, as will be seen later on, from the description of the colouration of the Victorian specimens.

Concerning the external anatomy Sedgwick also mentions the following points, all of which I am able to confirm in the case of Victorian specimens:—"The genital papilla . . . is between the legs of the fifteenth pair. The feet and legs resemble exactly, so far as could be made out, those of the New Zealand species. The feet have the median dorsal papilla so characteristic of that species; there are three pads on the legs, and a patch of blue pigment round the opening of the nephridia."

It is, perhaps, still doubtful whether any constant specific characters can be derived from the colouration of *Peripatus leuckartii,* but in the next section of my paper I shall endeavour to show that the colour and markings, however they may vary, are in all cases deducible from a typical and characteristic pattern.

VARIATION IN SIZE AND COLOUR MARKINGS OF PERIPATUS LEUCKARTII.

The variation in size and colouration of the species is amply illustrated by the thirteen Victorian specimens which I have been able to examine in the living condition, and I shall therefore confine my description to these. As I have already pointed out, Mr. Tryon, Mr. Olliff, and Mr. Fletcher have also given some account of the colouration of their specimens, which seem to agree with one or other of the Victorian ones. The size of the specimens probably depends principally upon their age.

The following is a brief account of the Victorian specimens. It will be seen that they form a series with two extremes—(1) the red, and (2) the blue (which becomes so dark as to appear black when the specimen is examined as an opaque object). I will begin with the red specimens:—

(a, b) The two specimens obtained at Warburton. The general tint is brownish-red, with only traces in one specimen of the bluish colour. The markings on the body are

singularly distinct and well defined, and identical in the two specimens. All down the dorsal surface there runs a median, broad, reddish-brown or chestnut-coloured band, divided into a series of diamond-shaped patches by regular lateral indentations—one diamond corresponding to each pair of legs. In the middle of this band there is a thin, median, whitish line. On either side, the chestnut-coloured band is edged by a narrow black line, which follows the indentation of its margin; and outside of this comes a broad band of darker brown, and then at the edge of the dorsal surface a narrow band of light brown. The ventral surface is light yellowish-brown, speckled with spots of very dark pigment, especially abundant at the base of each leg. In the mid-ventral line there is a row of white spots, one between the two legs of each pair, except the first (?), and the last, where, of course, the genital opening is situated. The antennæ are light brown, closely ringed all the way up with very dark brown or black. One of these specimens, when crawling, measured thirty-nine millimetres in length.

All the remaining specimens are from near Ballarat, obtained by Messrs. Nye and Avery.

(c) Very much resembles the Warburton specimens.

Dorsal Surface.—General colour, chestnut. The diamond-shaped segmental markings are continuous and very strongly marked, of a rich chestnut-red colour, edged with black shading off into dull red. A thin median white line is present, edged with grey.

Ventral Surface.—Much lighter. General appearance yellowish; spotted with yellow papillæ. There is a dark bluish-black spot at the base of each pair of legs, continued up the leg as a thin line. There is an oblong spot of a light yellowish colour between each pair of legs but the last. The legs are planted on a dark line, and the ventral surface of the legs is pale reddish-yellow. Genital papilla cream-coloured. Antennæ pale reddish-yellow, ringed with bluish-black.

Length, when crawling, thirty millimetres.*

(d) General appearance dark, blackish. Markings as in *c*, but with the red much duller and less conspicuous. There is a small light spot at the apex of each triangular half of each diamond-shaped patch on the dorsal surface. These spots appear to be present in most, if not all, specimens where the

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* Length always exclusive of antennæ.

diamond markings are visible. The genital papilla is cream-coloured, with a slight orange tinge; and the antennæ are reddish towards the base, and black at the tips.

Length, when crawling, twenty-three millimetres.

(*e*) This specimen was light coloured, and translucent in appearance.

Dorsal Surface.—There is a very strongly-marked continuous band down the middle, formed of a series of segmentally-arranged diamond-shaped patches of pale reddish yellow, edged by light, dull, indigo blue, shading off into pale yellowish red, with dull indigo blue papillæ. A thin median light line is just visible.

Ventral Surface.—Lighter. Pale, dull bluish, with a row of pale reddish-yellow areas, one between each pair of legs. A dark patch at the base of each leg continued up the leg for a little distance as a thin stripe. Ventral surface of legs pale reddish-yellow. The legs are planted on a darker stripe of dull indigo blue. Genital papilla, orange. Antennæ, pale reddish-yellow, ringed with dull indigo blue.

Length, when crawling, twenty-two millimetres.

(*f*) This was a very young specimen. It had apparently just died, but was in a perfectly fresh condition, when I came to examine it. Its general appearance was dark.

Dorsal Surface.—Dark, dull blackish, with a thin median lighter bluish line, with brownish-red papillæ so disposed as to form segmentally-arranged diamond-shaped patches, one over each pair of legs, as usual.

Ventral Surface.—Dull blackish, with a tinge of indigo blue; thickly spotted with greyish-yellow papillæ. There is a median row of lighter, brownish-grey areas, one between each pair of legs but the last. Genital papilla, orange. Ventral surface of legs chiefly reddish-yellow. Antennæ black.

Length, when lying still, seven millimetres.

(*g*) *Dorsal Surface.* — General appearance almost black, dull, with a slight dull reddish tinge. A very thin, light median line, edged with black, is scarcely visible. Segmentally-arranged diamond-shaped patches, one over each pair of legs, are faintly indicated as redder splotches, each divided into two triangular lateral areas edged with black.

Ventral Surface.—General appearance light reddish, with yellowish papillæ. There is an elongated lighter spot between each pair of legs but the last; and there are dark spots at the base of each leg, each continued some way up the leg as a thin, dark stripe. Ventral surface of legs pale yellowish-grey, with perhaps a dull bluish tinge. Genital papilla, orange. Antennæ grey, ringed with black.

Length, when crawling, thirty millimetres.

(h) General appearance dark, blackish.

Dorsal Surface.—Dull black, with tinges of indigo blue and red, and with the faintest possible indications of diamond-shaped markings. A thin median lighter stripe is present.

Ventral Surface.—Paler. Blackish, with a reddish tinge and pale yellow papillæ. There is a dark patch at the base of each leg, continued up the leg as a fine stripe, and a pale reddish spot, divided transversely into two halves, between each pair of legs but the last. Ventral surface of legs pale yellowish-red. Genital papilla, orange. Antennæ yellowish-grey, ringed with black.

Length, when crawling, thirty-two millimetres.

(i) This was a small specimen, which died just before I came to examine it in detail, possibly from too much handling. There is a small white papilla on the ventral surface of each leg of the last pair, on each side of the genital aperture, and the genital papilla is less prominent than usual; hence the specimen is doubtless a male. It presented a peculiar character, which I have noticed in no other case, namely, that the eyes were bright red.

Dorsal Surface.—General colour dull indigo blue, rather pale. There is a median, thin, white line; with a row of yellowish spots on each side of it, placed one over each leg and each formed of a single papilla. There is a lighter band of blue over the rows of legs, which are themselves planted on a darker line.

Ventral Surface.—Paler blue, with light yellowish papillæ. A row of median light yellowish spots, one to each pair of legs, and a darker patch at the base of each leg as usual Ventral surface of legs pale yellowish, with a blue tinge Genital papilla, cream-coloured.

Length, in spirit, ten millimetres.

(k) Dorsal Surface.—General appearance black, with a greenish tinge, especially pronounced on the antennæ. A thin median light line is present, and on each side of it a row of small, pale red spots, one over each leg, and each, apparently, consisting of a single papilla.

Ventral Surface.—Grey, with pale yellow papillæ, and, perhaps, a tinge of bluish. A median row of yellowish spots as usual, and also a darker patch at the base of each leg, continued up the leg as a thin dark line. The ventral surface of the legs is pale yellowish towards the apex, and the genital papilla pale orange.

Length, when crawling, twenty-four millimetres.

(l) Dorsal Surface.—As in *k*, with identical markings.

Ventral Surface.—Paler, with same markings as in *k*, but more greenish-blue. Genital papilla, cream-coloured.

Length, when lying still (dead?), ten millimetres.

(m) This specimen was killed, apparently by having the secretion from the oral papillæ of another specimen ejected over it.

Dorsal Surface.—General appearance black, with a thin median light line, as usual. The diamond-shaped patches are represented, as in the last described specimens, by a row of light red spots down each side.

Ventral Surface.—Paler. Blackish, with pale yellow papillæ scattered over it. A median row of lighter yellowish spots present as usual.

Length (dead) seven millimetres.

(n) Dorsal Surface.—Black, with a median thin light line and a row of red spots down each side, one over each leg.

Ventral Surface.—Black, spotted with pale yellow papillæ. A median row of lighter grey patches, one between each pair of legs. Ventral surfaces of legs yellowish-grey. Genital papilla, yellowish-grey.

Length, when lying still (dead?), seven millimetres.

From these descriptions, it appears that the following are more or less constant characters of the species with regard to colour and markings:—

(1) The predominant colours are red and indigo blue—the former passing into yellow, and the latter into black in some specimens.

(2) There is a thin median light line down the dorsal surface.

(3) The characteristic pattern on the remainder of the dorsal surface is a series of segmentally-arranged diamond-shaped patches, in which the red colour is

predominant. In some cases, viz., the darkest specimens, these patches are represented only by a row of small, light coloured, yellow or red spots on each side of the middle line. Each of these spots is situate in the position of the apex of each triangular half of one of the characteristic diamond-shaped patches found in other specimens.

(4) The ventral surface is lighter than the dorsal.

(5) There is on the ventral surface a median row of spots or areas usually paler than the rest of the surface, placed one between the legs of each pair but the last.

(6) At the base of each leg, around the aperture of the nephridium, there is a dark patch of indigo blue.

Whether or not the red colour of the eyes of the male will prove to be a constant character, I am unable to say, as I have only seen one male specimen as yet.

It will be seen, by reference to Mr. Sedgwick's beautiful illustrations, that the pattern on the ventral surface of *P. novæ-zealandiæ* is essentially the same as in *P. leuckartii*; while on the dorsal surface it appears to be very different, though the thin median light line is present in both species.

Mr. Fletcher tells me that he is inclined to think that the median dorsal white line (which is mentioned by Mr. Sedgwick as occurring in the Australian species) is a post-mortem character, due to imperfect preservation, as he has recently examined three moderately well preserved specimens from Queensland (probably from the same locality as Mr. Sedgwick's examples), and these have a distinct dorsal median dark line. Concerning his own Victorian specimen, Mr. Fletcher also says, in one of his published notes:—"A whitish median dorsal line visible in part of the body only is evidently due to bleaching, though in the rest of its course a nodose black line is not well defined." I cannot agree with Mr. Fletcher's views on this point. I have already pointed out that the white line is very thin, and sometimes edged by a dark line on each side. The white line might, I believe, be hidden by contraction in spirit specimens, and the presence of the dark lines edging it may account for the median dark line described by Mr. Fletcher.